

SOME OBSERVATIONS

ON

PULMONARY TUBERCULOSIS IN INDIA.

(With Notes on its Infectivity, Early Diagnosis
and Preventive Measures).

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GENERAL OBSERVATIONS.

In studying the subject of Tuberculosis the first thing that one notices, is the enormous advance made, especially in early diagnosis and treatment, as well as the interest aroused in the medical profession and the laity in the measures of prevention in Great Britain. But it also strikes me that these measures cannot straightway be appointed to India and it is necessary to examine them carefully and in the light of my past experiences, to adapt them to suit the present conditions of Indian life.

The present position in India with regard to Tuberculosis may be briefly stated as follows:-

(1) There are a large number of deaths from Tuberculosis annually in India.

Reliable statistical data are lacking as rules regarding notification are not strictly enforced, nor is certification of deaths always required, and many people are never under treatment of recognised medical men.

(2) Deaths from T.B. occur more in towns and industrial areas than in villages. This may be more apparent than real since in towns more reliable data are available.

(3) The prevalence of Tuberculosis can hardly be said/

said to be greater in one province than in another.

(4) The prevalence of Tuberculosis is found to be greatest in Mohomedans, then in Hindus, then in Eurasians, and lastly in Europeans resident for longer or shorter periods.

(5) No general preventive methods have as yet been organised against the spread of this disease.

(6) The public does not look on it as an evil to be combatted in the same way as malaria, plague, cholera and other highly contagious diseases.

Sir Havelock Charles in a short article on Tuberculosis in India in the Practitioner for December 1924 (page 393) states:-

"To sum up:-

- (1) Tuberculosis is no new disease.
- (2) It is now a common disease of the larger cities.
- (3) The general opinion shows that there has been a considerable increase during the past forty years.
- (4) That while the smaller towns and village districts had formerly a few cases, now in these it has spread widely.
- (5) The increase has been most marked in connection with those centres which have shown the greatest commercial and educational development."

Dr/

Dr Arthur Lankester who has been working in India as a medical missionary for over a quarter of a century and who carried out a special Tuberculosis Enquiry for the Government of India (1914-16) states in his book "Tuberculosis in India" (1920. page 9):-

"There is a widespread impression that tuberculosis is rapidly on the increase in India. The question, however, as to whether this increase is real or in the main only apparent, is one upon which there is a divergence of opinion. On the one hand it is believed that the disease has extended greatly during the last two or three decades and that its present rate of increase is such as to add seriously to the urgency of the problem of prevention. On the other hand it is held that this asserted increase is not confirmed by statistical returns and is for the most part attributable to more accurate diagnosis and improved methods of registration; that in fact, tuberculosis has always been a serious scourge in India, but that it has only recently been diagnosed as such and its seriousness recognised.

Careful inquiry would seem to show that there is an element of truth in both the above views; that in certain areas the supposed increase is in the main merely apparent but that in others, from well defined causes, there has been an extension of prevalence, the reality of which cannot be denied."

There/

There is a general impression in the minds of most people - even I had it before I started practicing in India - that it is not a common disease in the hot plains of India. Even the medical profession in India are to a certain extent to blame in fostering this idea - they seem unwilling to recognise the existence and shoulder the responsibilities which this recognition will entail. To the public so used to a rise of temperature - fever - a few additional symptoms such as cough, weakness, or even haemoptysis do not clamour for further investigation or preventive measures. Above all, the universal prevalence of malaria, cholera, plague, smallpox, dysentery, claim all the attention - even of the medical profession. How often have I seen in these few years, patients visiting doctor after doctor, sometimes getting benefit, sometimes going downhill, in whose blood some doctor at some time or other found the malaria parasite, and both doctor and patient were happy that they had found the cause. But the usual treatment with quinine did not effect a permanent cure and eventually the patient died with complications of great anaemia, loss of flesh and cough - still the case was probably labelled as (the anaemia of) malaria.

In some cases a concession might have been made that T.B. supervened. I do not think I am wrong in saying/

saying that many of these cases had tuberculosis first and malaria supervened and had tuberculosis been diagnosed early and treatment carried on along with the treatment of associated malaria, there would have been granted to the patient at least a longer span of life.

Dr Andrew Davidson in his book, "Geographical Pathology" (1892) says:-

"Phthisis occupies by no means an insignificant position in Indian pathology. The mean annual death rate of the European Army in Bengal from 1867 to 1876 stood at 1.38 per 1000. This figure is however much in excess of the later returns. The death rate from phthisis of the Indo European Army for the years 1881-84 was 0.69 against a ratio of 0.88 per 1000 among troops stationed in the United Kingdom. The death rate of the native army for the ten years, 1867-76 averaged 0.77 per 1000. From this we may infer that if the civil population were as well fed, clothed, and cared for as the native soldier, the phthisical death rate of India would be under that of Great Britain. There can however be little doubt that phthisis makes many victims among the cachectic and underfed population of India. In Bombay (City) the average death rate from phthisis for the years 1882-85 is given as 3.63 per 1000 - a proportion very much in excess of that of England".

Since/

Since that was written the position has certainly not improved.

Tuberculosis is regarded as part of the price we have to pay for civilisation. It is recognised as the White Scourge and as the white, black, brown and yellow people are everywhere coming closer and closer together - either in war or in peace - it may be anticipated that unless checked, no country will be ever comparatively free from the disease.

India claims to have passed through a long and eventful cycle of time. The majority of its populations have been strict vegetarians and even raised cows to the position of a diety. The Mohomedans in India would only partake of cow's and goat's flesh to the total exclusion of the pig, and yet Indians do not seem to have developed any high degree of immunity as is claimed for residents of European countries. The statement by Klebs that "the civilisation of the Chinese and Japanese antedates that of many of the white races but they are not protected by that degree of immunity which has come to the white people through centuries of exposure" - may it be applied to India? It would be interesting to know if the exposure of the Indians to tuberculosis is recent, and if so how recent - is it since European merchants sailed to India less than six centuries ago? As Hippocrates described disease like tuberculosis and as it is claimed/

claimed that India had a flourishing land route trade with all the countries to its west to Egypt and Greece, if that could have entailed any exposure it must have been too mild to create a racial immunity. And now at the present time there is not a very wide margin of safety from any such racial immunity.

The Ayurvedic and the Unani Systems of medicine that flourished in India long before the introduction of the western system of medicine (of Europe) have long treatises on "Consumption" and reference is continuously made in other writings of ancient times showing that tuberculosis was a well known cause of high mortality. It is also well recognised now by the laity as a disease distinct from the other prevalent "fevers". The words used to denote the disease in many different dialects can be exactly translated into the word "decline". It is looked upon as an invariably fatal disease since they only recognise it when it is far advanced, and often I found it difficult to make them realise that the onset of it was insidious and that the first symptoms of it are often trivial, because, they argued, the patient was at work and suddenly he had pyrexia and went downhill with cough and excessive sputum or haemoptysis. I have sometimes tried to convince them by analysing the previous health but the invariable answer was that those previous periods of ill health had been diagnosed by doctors as malaria/

malaria or some other diseases notably (nowadays) influenza or neurasthenia.

The public in India, while they recognise the serious nature of the disease do not seem to have set up any special 'god' or idol to the disease as there are special 'gods' and goddesses" to whose wrath are ascribed such diseases as cholera and smallpox. They look upon it as a divine curse which no intercession to a particular diety will remove. There is a popular belief that it takes eighteen years to cure which almost amounts to the same thing as being a fatal disease since very few persons have been found to survive this eighteen years ordeal. To the laity also, as in this country, haemoptysis is looked upon as the worst sign. To them it gives the worst prognosis.

The people of India have quite a different outlook on diseases from that of this country. The large masses are illiterate and even among literate people, whether of higher or lower education, there is very little belief in the actual infection theory of tuberculosis. They have however, a great belief that it is hereditary.

They do not understand preventive measures, they look upon them often as "tyrannical acts". They want 'cures' - rapid and certain - Therefore the quack thrives and it is an uphill task for the scientific school with slow but sure methods of prevention.

Every/

Every medical man in India has ample personal experiences of the difficulties of coping with epidemics even tho' the people think that something ought to be done for their protection. Such common experiences as that in a smallpox epidemic, the people hide the patients and show great unwillingness to have their children vaccinated or for any form of re-vaccination and inducements have to be frequently employed for this purpose, may be the same as in this country, but in these days of advanced knowledge one hardly expects a whole country in the grip of a plague or cholera epidemic to be unmindful of individual preventive measures as is the case in India, where even legal preventive measures are more often observed in the breach.

The people accept suffering and death with a resignation that has hardly any parallel in the western countries. They are the people who fully believe in 'Kismet'. They are surprisingly used to sudden deaths (in epidemics). Prolonged illnesses are equally accepted almost with a feeling of thankfulness that it is not one of sudden death. Among the lower middle classes there is now noticeable a certain amount of anxiety for the treatment of tuberculosis but it is also greatly obsessed with the idea of a 'cure' and that a speedy one. They go from one doctor to a quack and then to another charlatan, until/

until the disease is ended by death - very rarely by recovery.

The mortality rate is high in the cases that come under observation of medical men, but it is agreed that patients with consumption reach our hands in the very late stages. This evidently would not happen so frequently if the medical profession (especially those who are the general family practitioners of India - men trained in the Indian Colleges and Schools) was fully alive to the necessity of early diagnosis and treatment.

But the public mood at present is such that they will profit by a propaganda showing the benefits of early diagnosis and preventive treatment and if an intensive campaign could be inaugurated now the result would be very fruitful.

Sir Havelock Charles in the article quoted above truly says:-

"The spread of tuberculosis in India has much to do with social and other factors which are connected to a greater or less extent; (a) To simple ignorance of the elementary lines of health; (b) to the result of economical problems as difficult to solve as that of poverty itself; (c) to social customs which may or may not be capable of gradual modification in the interests of the community. Indeed social causes are more important than climatic in the spread of this disease./

It is in the amelioration of bad social customs that the educated classes can assist".

The subject has lately aroused a considerable amount of interest in India and the attention of many earnest workers have been engaged in the study of it.

REMARKS ON EPIDEMIOLOGY.

The epidemiology of the disease in India can hardly be said to have been studied at all. The difficulties of such a study are also great. India is a continent in itself with varied climates in its different parts. Each portion of the continent will have to be studied piecemeal and even then it will be almost impossible, I think, that we shall be able to connect up the whole and give a general expression for the whole of India.

Therefore, the present available statistics are scanty and unreliable especially for the rural areas. But whatever figures are available, it is certain they err on the side of understating the incidence. The machinery for collecting the figures in rural areas is very imperfect being mostly in the hands of lay officials. But on the other hand, the towns generally maintain a reliable system of vital statistics and data are available from the records of the British Army in India, the Indian Army and the jails. In the vital statistics of the general population we have many sources of error especially those due to wrong diagnosis of ailments and causes of death. It is an accepted fact that many cases of tuberculosis are not entered as such but are grouped under diseases of respiratory system, fevers, dysentery and diarrhoea.

Sir/

Sir Leonard Rodgers in his book "Fevers in the Tropics" (page 200) states that phthisis constituted about 9 per cent of total deaths said to be due to fevers. Other eminent workers have also arrived at more or less the same figure. Even the small rural hospitals' and dispensaries' records are full of the same pitfalls to the unwary statistician. So we can safely assume that in the figures for the general population there is no fear of an exaggeration of facts.

The data from the records of the army in India and the jails are very reliable no doubt but they are certainly not representative of the general population. The army generally consists of the most picked men who are stationed, housed and fed at a much higher standard than the average working man of India. The number of women on the strength of the army is negligible and that brings forward another source of error if one was depending on it alone. The jail population also cannot be taken as representative of the general population for several obvious reasons.

Even tho' the larger towns have reliable statistics, the point to remember in considering such figures is the fact that a large number of the sick people of the towns go back to their village homes to die. During the last two or three decades many parts of India have become large industrial centres attracting thousands of village folk to these towns and/

and when these sojourners find that ill health does not allow them to work in the towns they return to their village homes. This is the great cause of increase of pulmonary tuberculosis in the villages - often this rural area is at a considerable distance from the manufacturing town.

Therefore the comparison of one locality with another or even of the data obtained from any town with those obtained for an earlier or later period, is of very doubtful value.

But a study of the available statistics from these various sources (incomplete as they are) is very illuminating and I give below a few extracts:-

From "Statistical Abstract for British India from 1911-21 as presented to Parliament" (pages 404-405):-

India has a population of 318,942,480 according to the census of 1921.

There are 4897 hospitals and dispensaries (for all cases) and 44,024,683 persons suffering from all diseases were treated in these institutions in 1920.

Of these there were:-

(Indoor)

Persons treated for Tuberculosis of lungs

= 19,288

(Deaths = 2480)

Persons treated for other tuberculous diseases

= 14,480

(Deaths = 836)

(Outdoor)

Persons treated for Tuberculosis of lungs	= 43,644
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Persons treated for other Tuber- culous diseases	= 28,264
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Total	<u>105,676</u>
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The above figures give no indication at all of the number of tuberculous patients treated by private practitioners.

The Public Health Commissioner to the Government of India in his Reports for 1921 and 1922 states that for the general population, pulmonary tuberculosis, like pneumonia, is very largely a town disease: figures are available for a few provinces only. It has been noted for some years that rural areas which supply workers for big cities are being gradually made centres for tuberculosis. Thus Kolaba and Ratnagiri districts, the recruiting centres for Bombay City, returned death rates of 1.59 and 2.66. High rural death rates were also found in Surat (1.06), Kaira (1.92) and Ahmedabad (1.36) districts, all of which are intimately connected with industries on Guzerat or Bombay City. The gradual infection of rural areas cannot be viewed with equanimity. Bombay city is not the only danger: all the larger towns attract visitors. It is just as unsatisfactory to note that two important pilgrim centres - Nasik and Dakore - in which pilgrims are housed in more or less crowded/

crowded boarding houses return Tuberculosis death rates of 3.02 and 3.5 respectively.

BRITISH ARMY IN INDIA.

PULMONARY TUBERCULOSIS.

	Total Admissions	Total Deaths	Ratio per Admissions	1000 Deaths
1919	84	10	1.5	0.18
1920	81	9	1.4	0.16
1921	62	8	1.1	0.14
1922	51	9	0.8	0.15

INDIAN ARMY.

	Average Strength	Ratio per Admissions	1000 Deaths
1920	216,445	4.3	1.08
1921	175,384	3.8	0.83
1922	147,840	3.7	0.42

JAILS IN INDIA.

		Ratio per Admissions	1000 Deaths
1920	-	9.5	3.21
1921	-	8.9	3.06
1922	-	8.6	2.60

GENERAL POPULATION.

<u>Bengal Presidency</u>	Urban death rate	Rural death rate
1921	0.9	0.03
1922	1.0	0.03
<u>Bombay Presidency</u>		
1921	1.57	0.68
1922	1.60	0.64
<u>United Provinces</u>		
1921	1.49	0.01
1922	1.36	0.01

ANALYSIS OF REPORT OF THE MEDICAL OFFICER
OF HEALTH, CALCUTTA, FOR 1921 - 1922.

The number of deaths from tuberculosis was 2205 or 2.4 per thousand, a slight increase compared with 1920 when 2120 deaths were registered.

This is the highest figure recorded in Calcutta since 1907. It seems almost incredible that only a few years ago in 1917 the lowest figure ever known since reliable records were kept was registered and one could point out with pride to the rapid and uninterrupted fall in the mortality amounting to over 30 per cent in 4 years. With the advent of influenza in 1918 a terrible change took place; in 4 years 1918-21, the mortality has rapidly increased year by year, the increase amounting to 40 per cent. With a series of epidemics of influenza associated with grave pulmonary complications there is bound to be not only a general weakening of the powers of resistance but also local damage to the respiratory organs. These factors act in a variety of ways. Already infected persons die more rapidly. Latent infections light up; doses of infection which would be destroyed by the protective mechanism of a healthy body, readily produce the disease.

Although there were only 927 deaths recorded as due to influenza in 1920 the case mortality is so low, that/

that many thousands of cases must have occurred. That is to say for 4 years in succession the resisting power of tens of thousands of the residents of Calcutta has been lowered, even if only temporarily. With approximately 10,000 tuberculosis patients always in the city, spitting promiscuously like the majority of the residents, the high mortality from tuberculosis seems bound to continue for some time to come.

The great majority, 2095 out of 2,208 or 94.8 per cent were cases of pulmonary tuberculosis. The small proportion of other forms of tuberculosis appears to be due to the rarity of bovine tuberculosis and the universal custom of boiling milk before use. In Calcutta, tuberculosis spreads from man to man through the sputum which is freely expectorated all over the place.

The death rate amongst Mohomedans, 2.7 per thousand, was slightly higher than that amongst Hindus which was 2.3 per thousand. The community which suffered most severely was the Indian Christians, the mortality amongst them being 4.1 per thousand.

The poorer members of the Indian Christian Community have great difficulty in securing accommodation and overcrowding is marked.

The most remarkable feature of the statistics relating to tuberculosis in Calcutta however is the heavy mortality amongst females, particularly at certain/

certain age periods. The mortality amongst females was actually 3.7 per thousand or more than double that amongst males (1.8 per thousand).

As the following statement shows the heaviest mortality occurs among girls and young women.

Age Group	Death Rate	
	Males	Females.
10 - 15	.43 per 1000	1.9
15 - 20	1.4	6.5
20 - 30	1.8	6.7
30 - 40	2.5	5.2

For every boy or young man that dies of tuberculosis, four and five girls and young women die of this veritable "White Plague".

This can only be explained by overcrowding purdah system, early and repeated childbearing and prolonged periods of lactation mainly.

The King George IV Anti Tuberculosis League who established two dispensaries for tuberculosis in the City of Bombay mention in their report for the years 1920 and 1921 having treated new cases:-

	1920	1921
Males	370	467
Females	532	540
	<u>902</u>	<u>1007</u>

Age/

Age incidence - the highest ranges between the ages of 16 to 20, 21 - 25 and 26 to 30 in point of frequency. In wider terms it means that the greatest onslaught occurs between the ages of 16 - 30. Under 16 and over 30 the number gradually diminishes. The diminution is more marked above 30. After 50 the proportion becomes the smallest.

From the classification by sexes it is noticeable that Mahomedan women predominate. Living under the Zanana system and under the most insanitary conditions possible it is not at all surprising to find their number predominating. However the most interesting fact is that a great majority of these women show clinical signs of tuberculosis immediately after child birth. This brings us to the conclusion that premature child-bearing constitute the last straw in these women whose constitution has already been undermined by their prolonged seclusion in dark and closed up rooms.

The classification according to the nature of tuberculosis shows that out of a total of 1909 tuberculosis cases 1395 were of Pulmonary Tuberculosis, 429 Glandular Tuberculosis, 51 Bone Tuberculosis and 34 Eye Tuberculosis.

The report concludes by emphasising the necessity of enlisting to a very much greater extent the co-operation of the Medical Practitioners who should be induced/

induced to send cases before they are far advanced.

The report also brings forward some interesting figures as regards occupational incidence and influence of housing conditions on tuberculosis incidence.

From an examination of the Annual Reports of the Oriental Government Security Life Assurance Company Limited, whose head offices are in Bombay, Dr Lankester points out that the number of educated men (only such would insure with a Company like this) who altho' at the time of early manhood they were found upon careful medical examination to be free from consumption, yet nevertheless in later years did succumb to it.

Percentages of claims paid on death certified
as tuberculosis.

1910	-	9%
1911	-	10.2%
1912	-	12.2%
1913	-	12.9%
1914	-	8.4%
1915	-	6.6%
1916	-	6.7%
1917	-	5.8%
1923	-	9.0%

"Of these healthy leaders of society then,
tuberculosis/

tuberculosis claims in the end nearly 9 per cent as its own victims and yet these are the ones who ought to have the knowledge which in all probability would save them".

It is recognised that town life tends powerfully to increase the prevalence of tuberculosis. Overcrowding is the most mischievous factor in town life, but it does not appear that it has been able to exert a predominating influence on the course of tuberculosis. The substitution of industrial for agricultural conditions is an essential part of urbanization but the part played by this factor in the increase of tuberculosis is hardly susceptible to separate statistical analysis.

The same remarks apply also to such factors as social customs such as purdah system, early marriage, repeated child bearing and effects of prolonged lactation. These vary so much in different localities and in different communities in India that it is only possible to generalise in stating the main evil effects of them.

POST MORTEM ROOM INCIDENCE.

Sir Leonard Rogers as a result of a careful series of analysis of the post-mortem examinations made in connection with the Calcutta hospitals for a period of 22 years found that no fewer than 17 per cent of the total deaths had been due to tuberculous disease, while in 25 per cent of the cases examined distinct signs of tuberculosis were found.

A careful analysis by Dr Lankester of the post mortem records at the J.J. Hospital in Bombay for 1914 showed that out of a total number of 157 cases examined no fewer than 71 (i.e. 45.2 per cent) showed definite signs of tuberculosis while in 56 of these, i.e. 35.7 per cent of the whole, tuberculosis was noted as being the cause of death. Of the 56 fatal cases of tuberculosis 40 were from pulmonary phthisis.

These post mortems were carried out on friendless and homeless persons who had no relatives to arrange for either funerals or to withhold consent. Therefore it is not fully representative of the population as a datum.

NOTES ON INFECTION.

In ancient times the infectivity of phthisis was well known to medical observers. "It is of all diseases the most dangerous and fatal to the greatest number of mankind" - so said Hippocrates. Galen said that it was dangerous to pass a whole day in the company of a consumptive. Multiple infections in the same family were noted by Ballonius (15th Century). In England infectiousness of phthisis was well recognised in the 17th Century. Reference to the contagiousness of phthisis is found in "Humphrey Clinker" by Smollett.

The infectivity of phthisical patients were finally accepted only after the work of Koch in the early eighties of the 19th Century. Koch's researches have placed no small a debt to the progress of anti-tuberculosis campaign in every country.

The tubercle bacilli is a thin slender rod - size $2-3\mu$ by $.5\mu$. It is non-motile. It is an aerobe and grows best at an optimum temperature of 37.5°C . It has a temperature range of $30^{\circ} - 42^{\circ}\text{C}$ and grows best on a medium containing blood serum or glycerine.

A great deal of experimental work has been carried on with regard to the viability of this organism. It is very resistant to cold but in fluid media/

media they are killed at 60°C by an exposure of five minutes and at 90°C by an exposure of one minute.

Dry heat at 100°C takes one hour to kill. The results of an interesting series of experiments are given in the Indian Journal of Medical Research 1917 by Dr Soparkar at the Parel Laboratory in a paper on "Vitality of Tubercle Bacilli outside the body".

The resistance to dessication shown by the tubercle bacillus is one of its most significant biological features. Koch found that phthisical expectoration which had been allowed to dry and been kept at room temperature for five to eight weeks was still virulent at the end of the time. Dr Soparkar found that tubercle bacilli may retain their vitality for 309 days when sputum was kept in darkness even tho' it was completely dessicated.

The duration of the tubercle bacillus is much less when exposed to sunlight. Koch found that in direct sunlight they died after an exposure varying from a few minutes to several hours according to thickness of layer exposed. Diffuse light has the same effect after an appreciably longer time.

From these researches emerge the importance of fresh air and sunlight in destroying the virulence of the bacilli. The life of the bacilli is easily discouraged by unfavourable circumstance - "like an aphid by an eastern wind".

PORTALS OF INFECTION.

According to Zinsser, Calmette believes that when a tubercle bacillus "is deposited on the surface of the skin or a mucous membrane or is introduced into the healthy body by another route" it becomes the prey of leucocytes which carry it into the lymphatic circulation and into the blood. The leucocyte enzymes are not capable of digesting the organism and eventually the organism is deposited in the lymphatics when the leucocyte degenerates.

Tubercle bacilli may remain latent in the body, in lymph nodes, especially for long periods. It appears that the point of entrance of the tubercle bacilli into the body may be through the tonsils, and secondarily thence through the lymphatics, then to other organs. Pulmonary infection may be either by direct inhalation or indirectly through the lymphatics. Calmette believes that actual direct infection of the lung by inhaled bacilli is relatively rare and bases this upon experimental evidence. This however is not in agreement with the bulk of evidence, and direct inhalation is probably the most common manner of invasion.

According to the researches of Bartel and many others it appears that direct infection through the apparently uninjured mucous membrane of the intestinal tract may take place, and after such entrance the bacilli/

bacilli may be carried by the lymphatics and blood to the lungs and other parts of the body. Calmette states that in all susceptible animals, man included, and in all varieties of localisation, tuberculosis in the large majority of cases originates in a primary infection of the lymphatics which takes its origin by entrance of the tubercle bacilli thro' the mucous membrane of the digestive tract, chiefly the mucous membranes of the mouth, pharynx, and intestine.

Opie as a result of recent studies, states that first infection of tuberculosis may occur either by way of the lungs or the gastro intestinal tract and the occurrence of one lesion tends to prevent the other.

As Koch took up the position that if the primary lesion is not located in the intestine infection through food could not be assumed. But the modern tendency is to believe that tubercle bacilli can enter various parts of the body without previous injury or without demonstrable lesions and this is being confirmed by various feeding and other experiments. Infection through the alimentary tract occurs in a large number of cases.

The period of incubation is very uncertain. It is generally supposed to extend to years.

SOURCES OF INFECTION.

The commonest are:-

- (1) Close association with infected relatives, especially in overcrowded insanitary dwellings.
- (2) Occupational and industrial sources such as badly ventilated workshops or close association with infected co-workers.

SPREAD OF INFECTION.

The main means of spread are:-

1. Inhalation of dried particles of sputum.
 2. Inhalation of moist expectoration.
 3. Ingestion of tuberculous food material.
 4. Other modes of infection such as flies.
 5. Susceptibility to infection.
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INHALATION OF DRIED PARTICLES OF SPUTUM.

Dust contaminated with tuberculous sputum is met with in the vicinity of consumptive patients. Each such patient is a centre for dissemination of tubercular infection, whether he be more or less confined to his own residence, when the radius of potential infectivity is small or works or moves in assemblies of his fellow men, when the radius of infectivity is large. This radius of potential infectivity may be very greatly reduced, if not wholly eliminated, if the consumptive individual be trained to dispose of his sputa in a hygienic manner and be provided with the necessary apparatus to do so, provided that he conscientiously carries out his instructions. Persons in an advanced state of phthisis are often too weak or too indifferent to externals to be able to comply with such hygienic rules.

Multiple infections are commonly observed in Indian families. No better proof could be adduced than infections in the same family occurring when one member is phthisical or the attendant on the consumptive gets infected, of infection being caused by inhalation of dried sputum. The source of this infected dust is the dried expectoration of the patient.

Looking into the habits of the Indians with regard/

regard to spitting, I have always felt that urgent legislation is required on the subject. The Indians have a habit of chewing betel leaves and areca nuts or other spices which are always great sialogogues and everywhere in public spitting is practised indiscriminately.

In our III class railway carriages, nay, even in the II and I classes it is a great nuisance and we have no power to prevent it except by gentle persuasion, sarcasm or threat. But the Indian will never expectorate in a handkerchief or cloth, nor even blow his nose into one. He does so however on to Mother Earth, anywhere, in the privacy of his room or on the railway platform. as he is patiently waiting for a long over due train, or on the floor or walls of a public conveyance, and even in a public gathering he deposits his filth wherever floor space would permit.

In the dry climate and with constant strong breezes it gets a further lease of life as a dry powder and millions of tubercle bacilli must be constantly floating about even in a thinly populated town or village. Our only consolation lies in the fact that direct sunlight kills the bacilli in a few hours and we have as much of that as we could do with.

A section of the people who are very much addicted to this chewing habit carry about with them in their own houses or at friends' a brass vessel used as a sputum/

sputum cup. But even the use of this is decreasing with modern ideas of elegance and more is the pity since no substitute has been introduced for the old fashioned brass sputum pot, and there is no decrease in the chewing habits.

INHALATION OF MOIST EXPECTORATION.

Even admitting that the danger from dried sputum has been exaggerated, it is admitted that moist sputum is the commonest source of infection. I have seen several attendants on consumptives struck down before the patients they were attending on. I well remember being hurriedly sent for to the house of a consumptive patient and found that his younger brother aged 18 having a profuse haemoptysis. The boy was quite healthy and had a clear history and without any warning this haemoptysis came on and the lad was dead in three weeks while his brother who was already ailing for six months survived him for nearly two months. Every practitioner I spoke to has related similar experiences of multiple infection. Especially as the patient spits/

spits into the darkest corner of his room the bacilli can thrive longer. It is said that one and a half to four billion bacilli are coughed up by a consumptive in 24 hours. Surely the chances of these droplets during coughing and sneezing finding its way into other human beings are very great. And herein lies one of the greatest duties of the physician - in teaching his patients the proper disposal of their sputum and for the attendants to avoid the risks from this source. It is very easy to impress this even on an ignorant patient and his people and yet time and again I have been struck by the lack of such simple advice. The physician is generally too busy in diagnosis and treatment and forgets the elementary preventive measure.

INGESTION OF TUBERCULOUS FOOD MATERIAL.

Gradually we are coming round from our faith that the respiratory tract is the chief avenue of infection to the belief that the gastro intestinal tract may have an equal importance in affording a ready path for the bacilli. Any one who has seen the conditions under which food is exposed for sale in India cannot help feeling that all food must be highly contaminated. Indeed, so much so is it that the sale of cooked food in India is not at all popular and people would only buy such in exceptional circumstances, such as long journeys. But even in the home, conditions are not much better. Often have I seen food being prepared or stored in the same room as a phthisis patient. I once lost a good paying patient because I insisted on her leaving the store room where she was lying surrounded by her stock of food in considerable quantities. Though her days on earth were numbered she would not trust anybody to take charge of the stores in case they robbed! I took up the position that she was doing wrong in risking infecting the food to be partaken of by other innocent people, and she did not want a doctor who was a "faddist", so I got my dismissal.

In most parts of India bovine tuberculosis can hardly be said to exist at all. Various investigators have recorded their conclusions after careful enquiry on/

on this subject in the Indian Journal of Medical Research of different dates in recent years. Frequent examinations on milk samples do not show any contamination with tubercle bacilli. It is still a controversial point whether the northern provinces of India (the Punjab and the North West Frontier Province) is equally free.

Even if the chances of ingesting tubercle bacilli in milk from bovine sources are small in India there is no doubt that milk handled by infected persons or kept in close proximity to patient as I have often seen done in the crowded tenements of the poor, may infect healthy persons.

We, in India, have not got anywhere near the stage of an attempt to protect the public from ingesting tuberculous food by any milk or butter or other food laws. I have often seen tuberculous patients (even lepers) employed in food shops. It is our duty to point out the means of safety to our legislators and it is sure to bear fruit but there is no evidence that the medical profession is discharging this duty for it is a significant fact that not a single food act worth the name has been enforced in India. Little wonder then that the disease is claiming more and more victims each year.

Other modes of infection such as flies, utensils, and other fomites may be sources of spread and their importance has to be borne in mind in preventive methods.

SUSCEPTIBILITY TO INFECTION.

While the actual causative agent of tuberculosis is the tubercle bacillus and the source of the infection is always a consumptive person who scatters broadcast tubercle bacilli with his expectoration, there are many contributory conditions which favour the development of tubercular disease in the individual and its prevalence throughout the community.

Some of the supposed contributory factors are of doubtful significance and a general belief in their influence has of late years declined in the light of growing experience and observation. Among these may be mentioned the theory of the hereditary transmission of the disease and the allied theory of the transmission of a tuberculous or scorfulous diathesis. There is no evidence in support of these theories which will not serve equally well when used to illustrate the influence of other well recognised factors in the causation of tubercular disease.

Delicacy of constitution is certainly an important factor which predisposes to tuberculosis and this is doubtless inherited in many cases, but it in no sense constitutes a tubercular "taint", nor will the possessor of such a constitution contract tuberculosis unless exposed directly to infection.

Another host of contributory influences are found/

found primarily in the social conditions of the Indians of different classes such as the Zenana (purdah system), child marriage, early and repeated child bearing, prolonged and frequent periods of lactation, poverty, privation, sickness, bad housing, which includes inadequate ventilation, air space, and lighting of rooms, overcrowding, insanitary habits and surroundings, inefficient drainage, damp house sites and undrained subsoil.

Most, if not all of these conditions are inter-related, the factors are in themselves complex, and many of them may be in operation at one and the same time. Thus it is extremely difficult to determine with any precision the influence exerted by any one factor independently in the causation of tuberculosis. Poverty, privation, sickness, reduced resistance against infection, deficient clothing, negligence of primary hygienic precautions are all attributes of the complex condition which may be called "Social misery" and are associated with ignorance, inaptitude for work, insanitary housing, unclean surroundings, and overcrowding.

Among the contributory causes mentioned special reference may be made as follows:-

1. The influence of overcrowding and of insanitary housing may be considered together in relation to the spread/

spread of tuberculosis by "domestic infection". Tuberculosis is undoubtedly caused most often by "domestic infection". Considered theoretically the probabilities are in favour of this view. The degrees of the risk of infection depends largely upon the duration of the exposure of the healthy person to the risk of infection and upon the quantitative value of the infective agent to which he is exposed. Both elements of risk must obviously be greater within the narrow limits of a dwelling, where the healthy are exposed to infection from a consumptive for many hours on end by day and night and for periods of months or years, than in workshops and places of public resort. I have come across more cases of tuberculosis in our labourers in towns who live in well built rooms provided for them by the employer than those casual labourers who live in flimsily constructed huts - doubtless due to the ventilation. The Indian labourer is not yet used to windows and he does not like to have them open since he may be robbed - he does not believe in banks. His savings are in some corner of the room he occupies.

2. Poverty as a factor predisposing to disease is mainly applicable to the townsman but in the Indian village life it is not so important. The Indian villager is not starved if out of employment, if he can/

can return to his village where his kinsmen will look after him, may be in a half hearted manner, but even in town dwellers it is not very common to see actual destitution as the wage earners in a family support the unemployed by the system of the "joint family" - an institution peculiar to India which consists of several branches of the family clubbing together the joint resources under one roof.

3. Debilitating influences are principally the heat, malaria, intestinal troubles such as diarrhoea, dysentery, enteric fever. Such factors as extreme changes of temperatures in the different seasons of the year, other epidemics (plague, cholera, smallpox, etc.) have influence on the tuberculosis mortality and it is doubtful if they influence infection apart from any consequent debility lowering the individual resistance.

4. Nutrition - famines which are frequent in India owing to the failure of the rains and drying the crops are a factor to be reckoned with.

MIXED INFECTIONS.

It is the usual experience of Indian practitioners to find a patient suffering from a mixed infection. I do not remember a single film that I examined where tubercle bacilli were found that there were not always other bacteria, especially streptococci. It is said that bacteria can secure successful invasion of the tissues more easily in the tropics and except that our cases of tuberculosis are observed late when a mixed infection is expected I do not know of any other explanation of this frequency of mixed infection. I have felt that this point requires further investigation in India. I have often found improvement in the general condition by a course of polyvalent vaccine and seen cases where an autogenous vaccine, considerably prolonged the patient's life. But if our efforts are directed to keeping the patients condition free from such secondary infections from the beginning by preventive methods we shall see a great diminution in their occurrence.

NOTES ON EARLY DIAGNOSIS.

The point of importance in diagnosis is to ascertain whether the disease is active or latent. Is it manifest or occult?

It is here that Lord Curzon's significant phrase "Intelligent anticipation of events before they occur" may most aptly be applied. To accomplish this, no line of investigation should be ignored. Surely we need not shrink from finding in the living what we so commonly see in the postmortem room.

While there are many methods of diagnosis, enlightenment must be sought by a judicious review of all the evidence available rather than by reliance upon special procedures.

Then again, some of these special procedures are only available in our large cities or centres and too often the practitioner in the remote village feels that he is unable to do his best for his patient - even in giving a definite diagnosis.

And often this diffidence in giving a definite diagnosis is not due to a lack of diagnostic armamentarium but to a lack of sufficient courage on the part of the doctor to give a definite diagnosis in a slight case.

If we added to this, the natural sensitiveness of the Indian which always tends to make him most guarded in his opinions as he dreads having to uphold his judgment/

judgment against scoffers, medical and lay, we have another strong reason why we ignore to look the question of consumption in the face.

The prevalence of a large number of advanced cases is a great proof that the early cases are missed in diagnosis.

Owing to the heavy sickness rate in India the doctor is generally an overworked person. Moreover, so many come with very minor complaints easily cured with a dose of quinine or castor oil that we lose sight that more serious conditions may be lurking behind.

Edward Goodeve made an excellent observation upon this point in his Cawnpur Dispensary report for 1845. "We make it a rule to examine the condition of the chest in all cases of chronic diarrhoea, dysentery and so called remittent, but frequently hectic fever and in continued fevers in the cold season. The patients often make no complaints of chest disease themselves, their attention being concentrated on the symptomatic fevers and diarrhoeas, or failure of strength. It is necessary to question them closely, to watch the general symptoms of lung affections, and generally to resort to auscultation before coming to a conclusion as to their real complaints. Within twelve months, we have met with every form of pulmonary disease, except the malignant ones tubercular/

tubercular phthisis we have had an abundance of."

In spite of the various new tests that have been introduced, the importance of physical signs and symptoms must not be lost sight of, and in this direction many investigations have recently been undertaken which have thrown new light on those old established methods of diagnosis.

In these days of specified specialists little wonder that we are frightened in the remote corners of the world far from actual contact with the bacteriologist with his elaborate laboratory equipment who dares us to diagnose T.B. without the complicated processes of complement fixation test and allied methods. The expert radiologist is to us almost a magician who reads the fate of the tuberculous in his wondrous dark room on plates of glass.

In the midst of all the advances in the modern methods in diagnosis I was glad to read the following paragraph in Dr H.H. Thompson's "Tuberculosis and Public Health".

"In the diagnosis of pulmonary tuberculosis the general practitioner must still rely to a large extent on his powers of observation, his stethoscope and the examination of sputum. This fact emphasises the necessity and importance of special instruction to medical students in the early diagnosis of tuberculosis. Practical instruction in the character and quality/

quality of the normal sounds is essential before the student can correctly appreciate the fine deviations from the normal which are characteristic of early pulmonary tuberculosis, while special instruction in the character and significance of early adventitious sounds is also essential".

In order that we may not be too optimistic as regards these old established methods of diagnosis, I may quote another paragraph from Dr R.C. Wingfield's "Modern Methods in the Diagnosis and Treatment of Pulmonary Tuberculosis":-

"The second reason (for missed diagnosis) appears to be an improper appreciation in the diagnosis of pulmonary tuberculosis. This sounds an heretical and "new school" idea, but let me hasten to add that in spite of this I am in full agreement with Sir James Kingston Fowler, when he says in the obituary dicta of his book: "Those who advise that all stethoscopes should be scrapped may be influenced by the fact that they do not know how to use them" and again later "A stethoscope is easier to carry than a cardiograph or an X-ray installation Neither are common in the bush stations of West Africa". But I must reaffirm, and that with the heaviest emphasis, that in the diagnosis of many cases of early pulmonary tuberculosis the stethoscope may be absolutely useless, and if undue importance is credited to its findings in/

in these cases, it becomes a dangerous instrument.

* * * *

Skill with the stethoscope is not a matter of brains or cleverness, it comes mainly with constant daily practice, and if the doctor who is using his stethoscope day in and day out for years together meets with a proportion of definite cases of pulmonary tuberculosis in which his stethoscope reveals nothing, it follows that this instrument must only take a relatively unimportant place in the equipment for diagnosing pulmonary tuberculosis to be used by the general practitioner."

In a busy dispensary practice without capable assistance we have generally to examine the patient physically first and if a positive suspicion is raised we go into details of history and symptoms. This may be contrary to all orthodox canons of 'casetaking', but with a certain amount of care and judgment it is not an important matter practically where we begin provided we arrive at a correct and definite conclusion.

It has also to be constantly borne in mind that the investigation has to be carried out in a very thorough and painstaking manner omitting no steps and after all the data are collected then the whole evidence may be weighed and a conclusion arrived at. There/

There is no single diagnostic or pathognomic sign of tuberculosis, and if we remembered that, there would not have been collected such a vast literature on the importance or otherwise of each and every sign or symptom that a tuberculous patient may present. In diagnosis, both signs and symptoms are of equal value. We cannot neglect either. Nor can we put our faith in the presence or absence of either.

"A broadminded consideration of all and their correlation into a complete whole so that we may get a broad and clear picture of one malady which we are called to treat".

Inspection of the bare chest may give no information at all in an early case or it may give very valuable information to the trained observer. Slight abnormalities as shoulder droop, prominence of the clavicle or the hollows above and below are often not noticed. Great care is also necessary in watching the movements either as a whole or as localities such as apices upper portion of chest, etc. - local lagging.

The skin often shows an unhealthy appearance.

Palpation.

Is of greater help in detecting any local lagging. The value of the vocal fremitus in early cases is doubtful.

Mensuration./

Mensuration.

Amount of expansion of chest is a valuable data and should not be omitted in any case.

Percussion.

Requires careful technique and a good ear for discriminating slight variations in pitch.

Tidal percussion, if properly done, is a very useful aid. In very early cases I do not think percussion helps the practitioner, but may lead to discovery of marked lesions in a patient not exhibiting any marked symptoms.

AUSCULTATION.

Most practitioners hurry thro' the other parts of the physical examination and come to place great reliance on auscultation. No doubt it is a very delicate and accurate method of examination, but if we depended on it solely or mainly we shall be constantly falling into pitfalls. "There is no auscultatory phenomena which of itself is pathognomonic of pulmonary tuberculosis and the alterations found speak for certain changes in the pulmonary tissue, which may or may not be due to tuberculosis and only by their locality, persistence and association with other symptoms do they acquire diagnostic value" (Klebs.) This should be the watchword of every practitioner as he handles his stethoscope with a tuberculous patient before him.

There are three things mainly in auscultation that concerns us:-

1. Any deviation, however slight, in the normal breath sounds - either during inspiration or pause or expiration. To appreciate any slight deviation in the normal breath sound one's ears must be absolutely familiar with the normal - it may seem strange to make such a statement but it has been my unfortunate experience that many reputed practitioners who can easily tell any gross difference in the condition of the lung find it hard to appreciate slight prolongations/

prolongations of the expiratory murmur or roughening of the breath sounds or even the slight feebleness of the respiratory murmur - and these slight variations from the normal sounds are the important points in our examination for this specific early condition.

2. Adventitious sounds.

Of these, for purposes of early diagnosis we are concerned only with the fine rales or crepitations as with the progress of the lesion these rales acquire more pronounced and easily detected characters.

"These rales are composed of a succession of minute, dry, short, sharp, cracklings, few in number, rarely exceeding three or four in a respiration, co-existing exclusively or almost exclusively with inspiration, though in very rare cases most obvious in expiration - permanent (that is not removed by cough) in the great majority of cases after its character has once been perfectly developed ... passing into the moist crackle". (Klebs).

It cannot be too emphatically insisted that rales, to have any diagnostic value in early tuberculosis, must be strictly localised, in the majority of cases to the apex, and permanent; transitory rales having no value at all, though rales may be absent temporarily.

Pleural adventitious sounds.

Pleuritic friction or rub may be present as a very/



very early feature. Generally the involvement of the pleura giving rise to adventitious sounds is a late manifestation.

3. Vocal Resonance.

If consolidation is present the vocal resonance is louder, its quality is altered and it becomes nasal in character. In the early stages, changes in the vocal resonance are not very dependable signs.

Thick walled, muscular, and emphysematous chests are always difficult to examine and slight lung abnormalities in these may be easily overlooked. The presence of bronchitis often leads to erroneous conclusions.

History.

No one who has not practised among the poor of India can fully realise the woes of the doctor when he tries to collect a relevant history of the patient's health. In most cases the patient would be content to have his main symptom alleviated and is unwilling and often incapable through stupidity to describe his sensations. Great patience is required in eliciting a family history.

Symptoms.

In most cases a persistent cough brings the patient to the doctor and always a history of loss of weight and gradual weakness can be made out. The man has noticed a falling off in his working capacity. Apart from laziness, that has been the complaint with which the ordinary working class man comes first to the doctor for a bottle of "tonic". Neurasthenia, malaise, digestive disturbances such as anorexia generally pass unnoticed by the working man, but these are symptoms that bring the patients from the rich and middle classes to the doctor.

Dyspnoea or pain over chest may attract our attention to the condition of the lung. The patient often comes to seek advice about his heart.

Fever is so often a complaint that we have got into the habit of thinking that it cannot be anything but/

but malaria. It is only when the patient bitterly complains that the quinine is doing him no good that we seem to puzzle our heads about the fever being caused by some other organism. This is the most fruitful source of our missed diagnosis and it cannot be too much emphasised that our view of complaints of fever by patients must take a broader outlook than the only prevalent disease, malaria, affords.

In a hot country it is not unusual for patients to overlook excessive sweating especially at night. This is seldom a complaint patient seeks advice on and is elicited by leading question.

Haemoptysis always brings the patient at once to the doctor. We have to decide if it is from a tuberculous lung or not. Its differential diagnosis is not complicated. In the case of a young adult, with or without other symptoms of illhealth, the appearance of a free haemoptysis or of streaks of bright blood in a persistent sputum may be taken as practically diagnostic of pulmonary tuberculosis; and indeed it is important to remember that a brisk haemoptysis is often absolutely the initial symptom, and that a large haemoptysis may occur without previous cough or sputum and without the stethoscope revealing any abnormalities in the lungs.

Fistula in ano, and amenorrhoea are often the first complaint that leads one to suspect tuberculosis.

Early/

Early in the lesion a secondary anaemia is a fairly constant symptom. Careful practice of the above clinical methods generally leads to the acquirement of a diagnostic intuition which is a valuable asset to the worker.

Among other necessary procedures the temperature properly kept in a chart is a great help in early doubtful cases. This can be combined with a record of the patients pulse. All types of temperature may be met with especially in the tropics but other causes of a swing can soon be eliminated. It is surprising how often the patient does not know of the presence of fever and vice versa. The chart soon settles the dispute.

SPUTUM EXAMINATION.

In India this has to be more often done by the doctor as the public funds are not available for such purposes. It may be mentioned here that no number of negative results can exclude the presence of tuberculosis. It is important also to realise that the discovery that some other micro-organism is constantly present may afford valuable clinical indications.

It is not easy to find the bacilli in sputum in the early cases. Indeed if one is to wait for the diagnosis of pulmonary tuberculosis till the bacilli was found in sputum one would surely miss a large number of early cases.

Owing to the very general use of tuberculin nowadays a discussion of its merits is almost essential in dealing with the question of diagnosis. My experience leads me to say, that, the use of tuberculin as a routine test, is undesirable, owing to the admitted difficulties which the inexperienced (in T.B.) medical practitioners would meet with in an endeavour to interpret the results gained thereby. Its use is called for only when all other methods are exhausted and then only after a careful consideration of the pros and cons.

There are open to us two main types of the test, the/

the cutaneous and subcutaneous. They are distinguished by the fact that, in the case of the cutaneous test, where the tuberculin is introduced into the tissue spaces of the skin or mucous membrane, the reaction remains localised at the point where the tuberculin has taken effect; whereas subcutaneous infection brings the tuberculin into the circulation, and in addition to general signs of reaction sets free processes tending to hyperaemia and exudation in the tubercular focus.

The chief of the cutaneous tests are:-

- (1) Von Pirquet's test which consists in innoculating the skin with tuberculin much in the lines of vaccination against small pox.
- (2) Calmetts's ophthalmic test which is similar in that it relies on the sensitiveness to tuberculin of the conjunctival sac.
- (3) Moro's percutaneous test - This is done by rubbing a piece of 50% tuberculin ointment for one minute into an area of skin about ten inches square.

There are other modifications of these tests, being mainly attempts to overcome the excessive delicacy of the cutaneous reaction, by using various dilutions of tuberculin.

All of these tests are capable of deciding the presence/

presence of an infection with the tubercle bacillus, but the point in diagnosis is not whether an infection has occurred, but rather whether the tubercular disease is active. The high mortality from tuberculosis during the first three years of life indicates that, at this age tubercular infection and tubercular disease are practically synonymous. Therefore for infants and young children a positive tuberculin test has to be regarded as showing the presence of active disease. In children of school age and adults it is of little value except when negative.

Koch's subcutaneous test consists in the hypodermic injection of different dilutions of tuberculin. This test alone affords evidence of the site of the disease by means of the focal reaction which it arouses and may thereby demonstrate its activity and a rapid reaction to a small dose may be said to denote a recent infection.

But that there is danger in applying this test, I think any unbiassed observer will admit and that this is alone due to faulty technique I do not believe.

My conclusions concerning tuberculin diagnosis are the following because of the present limited opportunity in India of obtaining the requisite skill in the practice and interpretation of the test.

- (1) It should be confined to those cases in which the physical signs are indefinite and circumscribed.
- (2) It should not be used in pulmonary cases at all events, where fever, a history of recent haemoptysis or a gross lesion is present.
- (3) It should not be used in cases with marked malaise or debility.
- (4) It should not be used where septic conditions are suspected.

There is an error in the subcutaneous injection of old Tuberculin which I believe is of importance, and that is the possibility of obtaining an anaphylactic reaction due to the presence of non specific proteins.

LABORATORY METHODS IN DIAGNOSIS.

Though properly equipped laboratories where the most recent methods in diagnosis can be carried out are at present situated only in our big towns, with the advancement of knowledge, the smaller laboratories will also be anxious to undertake the work. Especially if there is a demand for such work and practitioners are anxious to have their materials thoroughly investigated it would not be long before we are in a position to supply that demand.

SERUM REACTIONS.

A. The Agglutination Serum Test.

Many efforts have been made, notably by Arloing and Courment, to introduce an agglutination test on similar lines to the Widal test for blood serum for typhoid. These authors overcame the great initial difficulty of obtaining homogeneous suspensions of tubercle bacillus free from clumps by a method of cultivation, and thus were able to employ the method for diagnosis and Robert Koch still further improved the method. The general conclusion arrived at the present day is that "the phenomenon of agglutination of/

of tubercle bacilli by blood serum is an important criterion of the formation of specific immunising reaction products in the specific treatment of tuberculous cases by means of tuberculin, but as a diagnostic measure especially in early cases, it is absolutely worthless, because the serum of an active tubercular case frequently contains no agglutinating properties while on the other hand, the blood of a case of infection already a long time quiescent often shows a positive reaction.

B. The Method of Opsonic Index Estimation.

Wright's method of determination of the opsonic power of a serum as regards the tubercle bacillus, that is the estimation of the measure of the content of the blood serum in certain specific anti-bacterial substances is also for diagnostic purposes. If the "Opsonic Index" lies above or below certain limits, it is permissible to conclude the presence of a tubercular lesion. It is generally accepted that the technique involved in carrying out the test is laborious and difficult and that only in the hands of the most practised are the results obtained sufficiently reliable for diagnostic purposes.

C. Cobra venom Activation Method.

Cobra venom alone in strong dilutions does not affect the haemolysis of red blood corpuscles:

Calmette claimed however that the blood serum of cases of pulmonary tuberculosis (94 per cent of successes) when added to diluted cobra venom brought about activation and complete haemolysis of the red blood cells. But other authors obtained similar results in from 50 to 80% of non-tuberculous patients as well as with serum of other diseases and nephritis.

D. Passive Anaphylaxis Test.

It has been proposed to make use of the phenomenon of tuberculosis anaphylaxis. Healthy guinea pigs into which the blood serum of tuberculosis patients has been subcutaneously injected become passively hypersensitized so that a subsequent injection of tuberculin produces in them the typical phenomena of anaphylaxis. Unfortunately the results are not reliable. In tuberculous cases, without exception the reaction is positive but other sera frequently give positive results.

E. Complement Deviation or Fixation Method.

The Bordet and Gengou reaction determines the presence or absence of specific antibodies (amboceptors) in/
in/

in the serum. It is the basis of the well known Wassermann (Syphilis) reaction, and has been prepared by the author for the diagnosis of tuberculosis. Unfortunately however the results obtained have not proved reliable; the serum of clinically non-tuberculous often show the same complement diversion phenomena as that of a case of manifest tuberculosis.

In the Edinburgh Medical Journal for March 24th Dr Nimmo Smith and Dr Fergus Hewat give details of their work on the complement Fixation reaction, and the conclusions of Dr Nimmo Smith, Bacteriologist, are as follows:-

- (1) The test is positive in the great majority of cases where the presence of tubercle bacilli put the diagnosis beyond doubt (86.4 per cent).
- (2). A large number of patients with clinically active tuberculous lesions give a positive result (55.8%).
- (3) In a high percentage of patients with clinically inactive lesions the test is negative (85.7%).
- (4) A certain number of apparently non-tuberculous subjects may give a positive reaction.
- (5) Where the Wassermann Reaction is positive the Tuberculosis Complement Fixation Reaction may also be positive even where there is no evidence of tuberculous affection. Both tests should always be done.

(6)/

(6) While at present the test is not absolutely reliable and has therefore a relatively limited value in the diagnosis of a suspicious case, it may be of real value in the differentiating between an active or an inactive lesion.

The conclusions of Dr Fergus Hewat who was the clinician were as follows:-

(1) When definite clinical activity is present a high percentage of positive findings may be expected.

(2) The cases of slight or doubtful activity give varying results as interpreted by the serological test. Here, of course, the personal factor appears in estimating what may be regarded as clinical activity. My classification of the cases has been strict, and if I had reasonable doubt regarded the case as slightly active rather than chronic.

(3) Cases showing evidence of chronic lesions with no local or systemic activity gave few positive results, this opens up the whole question of the value of the test in prognosis.

(4) The association between tuberculosis of the lungs, chronic bronchitis and emphysema is an intimate one. In pensioners who have been exposed to gas warfare or the sequelae of influenza give rise to considerable difficulty/

difficulty in differential diagnosis. In a proportion of these doubtful cases, I feel the test is of real value in adding a fresh positive or negative point to the evidence already obtained.

(5) Further work is required on the test, chiefly from the point of view of closer relationship between the interpretation of physical signs, systemic phenomena, progress of the case, and serological findings in patients who show no tubercle bacilli in sputum after repeated examination. Patients showing positive tests and no bacilli in the sputum should have their blood tested every three months.

RADIOGRAPHY.

It is only available in the large towns of India. The majority of the practitioners hardly have it in their power to avail of it especially if the patient is unable to afford a long journey for this purpose.

A skiagram to be useful in early diagnosis requires expert manipulator of the instrument as well as a thorough knowledge of its interpretation by the clinician. Both these factors are lacking in India at the present date.

If tuberculosis in a patient presents to us in an advanced stage it is easiest of all diseases to diagnose. It is only during recent years that it has been very much brought home to us that prevention and successful treatment of tuberculosis can only be of any practical value either to the patient or to the doctor or to the community if it is diagnosed early. This problem of early diagnosis is now engaging the attention of medical and laity alike and we have to overcome the numerous difficulties that beset our path in training ourselves for the task. The secret of success here as everywhere is application and a 'capacity for taking infinite pains' - it may not reach such a standard as to make geniuses of all of us, but it will certainly lead us to a higher capacity to observe and reason and lessen the chances of a vitiated judgment.

NOTES ON PREVENTIVE MEASURES.

Curative treatment does not come within the scope of my thesis. In the past and even now our efforts are mainly directed along channels of prophylaxis. They have yielded results that have surpassed expectations. Every civilised country in this world have taken up arms against this common foe. It has been said that "disease is the reflection of the inadequate hygienic and sanitary standards. Wherever a high death rate from tuberculosis is found, a high death rate from other causes and especially a high infant mortality also exist. Indeed the death rate from pulmonary tuberculosis and the infant death rate constitute a useful and reliable index of the health standard of a community".

Investigations in most countries are showing an increase in tuberculosis. Even tho' this may be due to better and earlier diagnosis of cases leading to exposure of sources of infection either active or latent (such as in contacts) it is being more and more realised by the public in India that we should fall in line with other civilised countries to grapple with the situation. It is then the duty of the physician to guide the legislator in the best way to deal with both the 'soil' and the 'seed' so that the physician may not have the hopeless scavenging work in an attempt to destroy the prolific harvest so poisonous to his fellow/

fellow beings. When one sees the immensity of this antituberculosis campaign in Great Britain one realises what a stupendous task there is in front of us in such a vast country as India and we have need to mobilise all our forces and even cry for help from outside. It is therefore very necessary for us to examine carefully what are the ways and means open to us particularly and practically and even tho' the beginning may be very small and the progress very slow we shall have got so far as to take advantage of all that the active seekers of the means of emancipation from this white scourge can bring to light and thus be able to contribute our small share in the improvement of our country as part of the great brotherhood of the world. What is wanted is not a crusade to preach new opinions but to get everybody to act up to those he already has.

It is to be feared that physicians will have a far less prominent and active share in the honourable task of bringing about the saving results of that Sanitary Reform of which they themselves have been the sole originators, than their wishes and their exertions undeniably claim for them. Medical men are too strictly engaged in the personal and laborious details of their profession, in the hard competition for individual subsistence, and in the application of the laws of medicine to particular cases, rather than to/

to more extended measures for the public good, to be enabled to carry forward any very enlarged views for the improvement of national sanitary laws. The physician's own means of action are so narrow and his personal influence with those in power so limited, that he, unaided and alone can effect but little in the execution of the good work. It has been, and it is still, his task to design all that is now effected and all that may yet be achieved in the great victory of science and true civilisation over disease; but the fulfilment of his best intentions rests with others; and he must be prepared to find that when, under his guidance, the difficulties of the task have been surmounted, his part in the work will be viewed rather as that of a Christian Philosopher who, in the midst of his own trials and in direct contravention to his own lower and temporal interests, has employed his dearly bought knowledge in advancing the welfare of mankind.

The hidden power of mitigating disease appears to rest with man himself, less as a scientific than as a rational and a religious being: and he will find its development in resources which are perfectly open to him, - in the improvement of laws of nations and of societies; in the establishment of true religion and morality; in the rebuilding of cities and in the improvement of lands; and in a careful adherence to those/

those beautiful and easy laws, prescribed by nature for the regulation of mind and body which still remain within reach of all. It is undoubtedly with these, and not with the science of Physic that the key to the Great Arcanum rests. The Physician may do much towards effecting the consummation of the good work; but the Lawgiver, the Divine and the General Philanthropist could do all.

INDIRECT MEASURES AGAINST TUBERCULOSIS.

In discussing the forces that are to be mobilised in fighting the campaign against tuberculosis we naturally come to divide them into two groups. One indirect and the other direct. Both are attacks developed from the flanks. The frontal attack will be fully developed when chemo-therapy places a potent weapon in our hands. The outflanking movements - both indirect and direct are the modern preventive methods. The indirect method concerns the "soil" and the direct method concerns the "seed". Anything that improves the hygienic standard of the human being is welcomed by the sanitarian as a step in the right direction towards defeating the inroads of the tubercle bacilli. No matter for whatever specific purpose a sanitary improvement is done it is an addition to the forces. It may be far from the thoughts of the legislators to fight consumption, yet if it is one that takes the people a step forward in their standard of hygiene it is a step gained. Is it an antimalarial campaign? There is no need for a disappointment. That will help the anti-tuberculosis campaign. Is it a law passed to give increased pay to the worker? That helps. Is it a law to prevent profiteering? Does that help? The answer is obviously in the positive. It may be said that the legislators are always busy framing laws and all are meant to be for the advance of/

of the community and if every advance helps there is no need to cry for special health laws. But in the present age Mammon precedes Hygaea and unless the medical profession holds a watching brief for the health of the public over the activities of the legislators there is no doubt that Hygaea will not only take a place in the background but even be forgotten. My remark is almost superfluous when one reflects that it was only during the Victorian Era that most of the Public Health Laws in England were passed. Were there no necessity to have rigid public health laws before that?

Anything therefore that aims at improving the lives of human beings are the allies in this campaign. The minds of the legislators have to be constantly refreshed with regard to these.

Laws relative to food purity, to building regulations in towns and country, of towns and villages, to factory and workshops rules, and similar measures are not only to be pressed for but if brought forward have to be critically examined. If one compares the laws regarding public health passed in India and those in Great Britain, it is a most interesting study and one feels certain that it will take years before we can ever hope to come up to the standard attained here. Here the difference may be more apparent than real for such laws have to be made as are practicable for the/

the country itself and not a mere imitation.

The next ally to be mentioned are those organised activities in any community that aim at setting before its members (or outside it) a higher ideal of manhood. Such societies as the Y.M.C.A., Boy Scout Movements, Territorial Forces, Fresh Air Funds, Charity Organising Societies, Missions and Health Societies - in fact all public movements of a nonpolitical nature are great instruments in the improvement of humanity.

Maternity and Child Welfare movements have received a great deal of impetus in India lately, led by Lady Reading, the wife of the Viceroy of India.

I always welcome the multiplication of these institutions and there is plenty of room for all in India, especially those movements which encourage an open air life and physical development. I have myself been associated with many such and I always found that the greatest good came out of even the smallest of these. Even "people who come to scoff stay to pray". No one can deny their usefulness from the sanitarians point of view.

Even in Great Britain it seems to me that enough advantage is not taken to instil sound hygienic ideas into the child thro' educational institutions. In India where only a very small proportion of the population is literate the educational institutions become even more important as allies because the youth in these/

these schools are not only the fathers of the future, but they will be the guide, philosopher and friend of the vast illiterate majority of their contemporaries. And they should be won over to side with the Campaign. If the scholars were given even very elementary lessons in hygiene, I am sure it would be very useful to them in later life.

The other indirect methods consist mainly of propaganda work to educate the public in the dangers of the disease and the means of prevention. It requires considerable organised efforts to show quick results in any public health campaign but begun even in a small way, excellent results are often observed. In one little town in India an annual Health Week was started for the first time - the public were not very enthusiastic over it. Lectures, exhibitions, prizes were all utilised. The next year the interest shown (without any additional attractions being provided) were to say the least, four times more than the previous year. In most countries now this sort of propaganda work has been taken over by the non-medical portion of society. But in India it has to be mostly organised by the medical men and that is the reason to carry out intensive propaganda first among our own professional brethren.

DIRECT MEASURES.

Foremost amongst the direct measures towards prevention come the "Edinburgh System" of Sir Robert Philip. He has convinced the world that "no amount of treatment directed solely towards the individual patient could ever do more than touch the fringe of the Problem", by his wonderful development of the system and results shown therein.

The "Edinburgh System" consists of:-

- (1) The Dispensary.
- (2) The Sanatorium for incipient and curable cases.
- (3) Notification.
- (4) The Hospital for advanced cases.
- (5) The farm colony for convalescents.

The functions of the Dispensary are:-

- (1) It affords treatment to tuberculous patients including nursing and home medical attendance for selected indigent cases.
- (2) It affords careful advice on all matters connected with the treatment and prevention of tuberculosis.
- (3) It enquires for undetected cases of pulmonary tuberculosis.
- (4)/

- (4) It notifies such cases to the Medical Officer of Health for disinfection, statistical record and surveillance.
- (5) It provides for the home treatment and the nursing of indigent advanced cases.
- (6) It investigates and advises on hygienic conditions in home surroundings and brings contacts under treatment.
- (7) It works in close uniformity with the Public Health Department for the improvement of home surroundings and the eradication of tuberculosis.
- (8) It acts as a "clearing house" for tuberculous cases sending patients to sanatoria, hospitals for advanced cases, to convalescent and seaside home etc., or arranging for home treatment, nursing and medical attendance.
- (9) It brings indigent patients into contact with charitable societies municipal and poor law authorities, social workers, and similar agencies for affording financial and economical relief.
- (10) It follows its clients in their after career until permanent cure is determined, and helps them to a change of occupation when this is necessary.
- (11)/

(11) Generally it is the focus of disseminating instruction and information for the prevention and eradication of tuberculosis; and for organising treatment for the incurable.

Sir Robert Philip gives the following definition of a dispensary:-

"It is a central institution devoted to the guidance, supervision and assistance of the tuberculous poor. An information bureau. A clearing house. A centre for the supervision of home treatment. The connecting link or knot that completes the chain of other undertakings for the prevention of tuberculosis".

On Wednesday the 18th January 1925, at the Annual Meeting of the Edinburgh Royal Victoria Hospital Tuberculosis Trust, Sir Robert Philip said, that if they could show to the world that the prevention of tuberculosis was possible it seemed to him that they went much further than the mere question covered by cure. He could not help thinking that something was pretty far wrong with the methods of application of preventive medicine. If people only realised what they could achieve for themselves there would be far less need for such an institution as theirs. (Daily Press).

For Calmette, the preventorium or supporting dispensary/

dispensary is the essential instrument of social preservation against tuberculosis. It does not treat patients medically, that function belonging to sanatoria, hospitals and medical polyclinics. Its mission is to locate, attract and keep under supervision those among the very poor who are peculiarly exposed to tuberculous infection and those who are already affected. It selects patients suitable for sanatorium treatment and cure in the country or in seaside establishments. Patients dangerous to their surroundings are sent to Isolation Hospitals. Dwellings are disinfected and contaminated linen sterilised and washed. Spit cups and antiseptics are distributed.

Advice and Care Stations.

To supplement the work of the dispensary, there are in Germany a number of advice and care stations for the tuberculous. They do excellent work both in the medical and social combat of tuberculosis as a disease of the masses. In these advice stations patients are not treated but only examined and advised what to do and where to go. Investigations of home environments, social conditions, and the presence of other tuberculous members in the family are carefully made.

To all these activities of these different institutions, I would add that one of the most important/

important functions they perform is in training the medical practitioner to see the disease in all its phases - it acts as a centre of education to the profession and the other important function is that it keeps the public constantly reminded of the existence of the disease.

It is a remarkable fact, that simple tho' the Edinburgh System appears, it has not made any progress worth the name in India. This, to my mind, can only be put down to the apathy of the medical profession in India. The adoption of the system in its entirety may not be feasible in India but there is a great field of work open if only we were content to begin in a small way by a modified dispensary system - the first link in the chain of the Edinburgh system. A dispensary to my mind is not only a centre of education regarding consumption to the patient and the public but it can be a great centre for the education of medical men and students.

The number of beds in existing Sanatoria in India are far below the requirements even of the people who now would benefit by such a course of treatment and their extension is only a question of ways and means. Even without looking to activities on a large scale in this matter, small beginnings could be made by local communal efforts if only we were awake enough to its necessity - and what thoughtful/

thoughtful person can deny such necessity?

Notification brings to notice sufferers from tuberculosis to the Public Health Department who can then keep a watchful eye that the victim is not left uncared for should he be lacking in friends to give him a helping hand, and to carry out further preventive measures such as segregation, disinfection of dwellings, and surveillance as well as it is important in affording statistical data. But it is a very vexed question in India whether it should be voluntary or compulsory. Both sides in the country have weighty arguments. But there is no doubt that it will have to come - its advent can be hastened if any supervision of the patient that notification might entail could be assured to be unobtrusive and segregation was not made compulsory.

Segregation, however necessary in advanced cases, is most unpopular among Indians. They do not want to go to any hospital unless they can have their families with them. That would not be segregation. Overcoming this difficulty will tax all our tact and diplomacy.

Before we can attempt to educate the public we must educate the medical profession. There are those in the profession who cannot be recognised as doctors - as the term is understood in English - men who profess to heal and cure the sick without any systematic/

systematic training for it. But in India there is also a very large number of medical men who receive a fair training in the western system of medicine. These can be divided into two classes. Firstly, the graduates of the different Indian Universities, and secondly, a larger division of those that have had a lower standard of medical education. These are the men who have the largest clientele and come most intimately in contact with the patients - they are the "family doctors" of the masses. It is through them that we can expect the greatest help and their interest in tuberculosis preventive work has to be aroused. We have therefore to carry our propaganda work first among them.

A general adaptation in a modified form of the dispensary system in every town in India can be the only starting point of such propaganda. These dispensaries can be the same living examples as they are here. It is even more useful than an organisation like an Anti-tuberculosis League which starts with a flourish and then dwindle away. The study of journals and current literature is not a widely cultivated pursuit among the busy practitioners in the villages and smaller towns. To say the least they are not easily available to the slender purses of the village doctor or even a struggling young doctor in town. These men can be constantly invited to/

to send their doubtful respiratory cases to the dispensary for diagnosis. By taking their turns on different days on the staff they can study the methods of early diagnosis, and improve their skill in such. That will give them a "living" interest in such an institution. It can be the centre for collection of books, journals, specimens, X-ray photos of tuberculosis cases. It will also take an active part in the preventive work as well as "follow up" work of the patients that had come under observation. It will thus be a practical course of training in preventive medicine.

Such activities may not be serving the same purpose of the dispensary as is understood in Great Britain and it may be unable to show much fruitful work to the patients themselves but it is bound to have great educative influences on the doctors and medical students, and that will surely lead to great benefits for the future patients.

In India, clinical material can be obtained in abundance but no advance is made mainly for want of teachers, and teachers cannot be made in a day, nor even in a comparatively short time. It must take long and patient practice at teaching to become a good teacher. The medical men working at the dispensaries will be teachers and students at the same time, teaching each other, studying together.

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The needs of the "tuberculous" are urgent. Every medical man has a duty not only to those that are attacked and under his care but also towards the protection of the "innocents". We must not fail in the discharge of that duty. To satisfactorily perform that duty, Indian medical profession must become an active co-operator in the world's effort to emancipate itself from the "White Scourge".

CONCLUSIONS.

The point of view taken of tuberculosis in Great Britain and the methods adopted in the attempt to stamp it out has to be materially altered in dealing with the tuberculosis question in India. This is altogether influenced by the geographical, climatic, racial, religious, social and political considerations of the country. In the fight, we in India, can have certain advantages such as a drier climate, a range of choice of different climatic conditions, easier possibility of obtaining healthy occupation of 'cured' cases in agricultural pursuits or other outdoor life and even the stress and strain of competition in the struggle for existence is likely to ~~be~~ be lower than temperate climates for many years to come but on the other hand we shall have to face serious difficulties in the poverty or parsimoniousness of our government and people, in the apathy to prevention of infection among the masses, in the lack of unity to form organisations for sociological duties and many other obstacles. Without the aid of the public we cannot show brilliant victories in any sphere of public health work and to obtain this public aid the medical profession has to undertake the responsibility of educating the public and this responsibility can only be undertaken when the profession itself is educated as to the necessity of an active tuberculosis campaign.

CONCLUSIONS.

1. Tuberculosis in India is much more common than is generally believed even by the people of the country.
2. The disease is increasing.
3. The pulmonary type is relatively more common altho' every variety of other lesions are frequently met with.
4. So far only advanced cases have been perfunctorily treated.
5. It is essential that an early and vigorous campaign against tuberculosis should be undertaken.
6. The first step towards it is to awaken the interest of the large number of Indian trained practitioners to the practical methods of early diagnosis and treatment of tuberculosis.
7. The first need in this process of education is the establishment of Dispensaries where medical practitioners and students of medicine can become proficient in early diagnosis by having opportunities of examining all kinds of cases of tuberculosis.

8. Other preventive measures are sure to follow soon after the profession itself realises the actual position for themselves.

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